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Visual Impact Assessment: There's more to it than meets the eye!

SYNOPSIS The visual impact of a wind farm is one of the major causes of concern for all current U.K. wind farm projects. Often visual impact is the singlemost important issue on which a planning application is judged. A fair and honest assessment of the visual impact of a wind farm demands the co-operation of the developer, the planning authority, the public, and other interested parties. Visual impact assessment also demands that each individual involved in the planning process make their own judgement, because it is inadequate for this issue to be decided by a single individual.

1 INTRODUCTION

1991 was a particularly busy year for the UK wind energy industry. Prompted by the second tranche of the Non-Fossil Fuel Obligation (NFFO), planning application were made to local planning authorities for a large number of wind farms. For those wind farms awarded a NFFO contract, it is imperative that the progress of the planning application is not unduly delayed.

However, public concerns about the environmental impact of a wind farm, and especially its visual impact, have already caused considerable delays to many wind farm projects. In an attempt to alleviate such
concerns and to provide sufficient information for the proper consideration of a wind farm proposal by the local planning authority and members of the public, an Environmental Impact Statement (EIS), which has been prepared by the developer, often accompanies the planning application. The EIS should include an assessment of the visual impact of the wind farm.

This paper describes the authors' approach to visual impact assessment and is based upon the experience of preparing six such assessments on behalf of Renewable Energy Systems Limited (RES Ltd) for proposed wind farms in various locations in the UK. At the time of their preparation, there was little or no guidance on how to prepare a visual impact assessment of a wind farm, or what such an assessment should include, or even how the assessment should be presented. Since then, we have been able to observe the use of these assessments in the planning process and, more recently, several reports concerned with wind farm planning issues have been published. In the light of these reports and our experience to date, we review the usefulness and suitability of our approach to visual impact assessment and make some recommendations for future practice.

2 VISUAL IMPACT ISSUES AND ASSESSMENT TECHNIQUES

Wind farms must be sited in open locations. Consequently the wind turbines become highly visible additions to the landscape. The size and number of wind turbines to be erected on a site, the specific location of each in the landscape, and the rotation of the blades are just some of the factors that affect the extent to which a wind farm can be seen from the surrounding countryside. However, although a wind farm may be observed from a specific location, it does not necessarily follow that it will be regarded as visually intrusive. There are many factors that influence the visual impact of a wind farm, but it is the personal opinion and judgement of the viewer that is the most important. Since different people will regard the wind farm in different ways, the determination of visual impact is highly subjective. It is this subjectivity that makes visual impact assessment so difficult.

In visual impact assessment it is essential to separate the issue of visibility from that of visual impact. Our experience shows, however, that these issues are often considered to be same. We consider that they are not and, in order to prepare the visual impact assessments of six proposed wind farms, we sought an assessment approach that addressed these issues separately. Since we recognised that visual impact assessment was subjective, the aim of the approach was to objectively prepare sufficient

information from which the planning authorities could make their own fair and honest assessment of the visual impact of a wind farm proposal.

2.1 Visibility and the Zone of Visual Influence

The 'Zone of Visual Influence' (ZVI) describes those areas of land surrounding a wind farm site from which the wind turbines may be wholly or partially seen. The extent of the ZVI is, to some degree, a measure of visual intrusion but, most importantly, the ZVI identifies the limits of visibility of the wind farm. Several techniques have been utilised to identify the ZVI:

(a) Inspection of Ordnance Survey (O.S.) maps.
(b) Landform cross-sections.
(c) Theoretically computed ZVI.
(d) Identification of areas of public access or environmental sensitivity.
(e) Field study.

Inspection of O.S. maps allows a crude division of the region surrounding a wind farm site into areas of high ground (i.e. land areas that lie above the site) and low ground (i.e. land areas that lie below the site). An area of high ground close to the site will tend to provide a natural screen to the site, obscuring the views from more distant locations, so that only from those areas of low ground closest to the site is there a likelihood of the site being visible. Thus, this division provides an early insight into the likely visibility of the wind farm from specific locations in the surrounding region. Also, it is possible to predict the sort of view the observer will have of the wind farm if it is visible. From locations in high ground areas, the observer will see all of the wind turbine structure and be able to see the arrangement of the machines across the site. The wind farm will tend to be seen in the 'middle distance' with the visible horizon being defined by the landform features beyond. From locations in low ground areas, the observer will tend to see only those wind turbines closest to him, while those furthest away may be fully or partially obscured by an intermediate ridge or brow. Finally, since the observer is looking up towards the wind farm, the wind turbines will often be seen on the skyline.

Landform cross sections, drawn using the contour data taken from the O.S. maps, allow the visibility of the wind farm from a specific location to be tested. By including scaled images of the wind turbines on these diagrams, it is possible to be more precise about how much of a wind turbine might be observed. Using this technique, the 'line-of-sight' between two locations on the cross-section axis can be quickly verified. RES Ltd have taken this approach one stage further by using a computer to calculate all the possible line-of-sights between each wind turbine and the surrounding countryside. In this way a theoretical ZVI is derived. By repeating this search for line-of-sights taken from the base of each wind turbine and then taken from the nacelle of each wind turbine, a best case ZVI and a worst case ZVI are derived.

From these desk studies, an initial definition of the ZVI can be made. However, all of these techniques ignore local features and landscape elements whose influence cannot be assessed from maps alone. Consequently the significance of buildings, trees, hedgerows, embankments, and other obscuring elements can only be assessed by a field visit. However, rather than visit all of the ZVI and check the visibility of the site at each location, the field visit is restricted to areas of public access or of particular environmental sensitivity found within the ZVI. Such areas include towns, villages, major roads, footpaths, recreational areas, historic monuments, AONBs, National Parks, etc. The list of such areas to visit are identified from the desk study and have usually been agreed with the local planning officer prior to the field visit.

The field visit is crucial to the validation of the ZVI. Not only does the field visit involve going to the wind farm site and assessing the views from the site itself, but also extensive touring around the site to verify the visibility of the site from the agreed list of environmentally sensitive or public access locations. To ensure that the field visit provides a rigorous evaluation of the true ZVI, it is essential that the visit is made on bright, atmospherically clear days when there is no interference from obscuring weather conditions (e.g. heat haze, low cloud base, mist). A feature of the field visit is the need to check the visibility of wind turbines yet to be erected! If the site itself can be seen, so will the wind turbines be seen. Yet the site may often be obscured, especially when viewed from low ground, and so other existing landscape features (e.g. trees) must be used to assess whether the wind turbines themselves might be seen. Anemometer masts erected on the site are especially useful since their height often

corresponds to the hub height of the wind turbine. Visual aids such as binoculars are valid tools in this process, since the search for the ZVI concerns visibility and not the impact on the naked eye. Consequently, the field visit can extend to locations over 10km away from the site.

The result of the desk and field studies will be a description of the ZVI that accounts for local screening features and which is sensitive to areas of public access and visibility. The extent to which the ZVI includes large areas of public access within a 10km radius of the site is, to some degree, a measure of the visual intrusion of the wind farm. However, the ZVI provides only a measure of visibility and the visual impact the wind farm makes on a specific location within its bounds requires additional assessment techniques.

2.2 Visual impact

There are many factors that influence the visual impact of a wind farm. Several of these factors can be either measured, quantified, or simulated by some means, e.g. the distance from the observer to the wind farm, the number of wind turbines wholly and partially seen, the size and type of the wind turbine, the number of blades, the rotational speed of the rotor, the colour of the wind turbines, the arrangement of the wind turbines across the site, the ambient lighting conditions, the weather conditions, the field of view available, the elements seen in the surrounding landscape. These factors can all be objectively assessed, though the influence of each will vary according to the location from which the wind farm is being observed. For example, an observer who is in close proximity to the wind farm will be influenced far more by the characteristics of the wind turbines than a distant observer who will find the landscape around the wind farm to be more influential on the their assessments. The objective assessment of these factors, however, will provide only a partial assessment of visual impact. Visual impact assessment is complete only when a personal judgement about the intrusion on the view created by the wind farm has been made by the observer. This judgement will be based upon other factors that are more subjective by their nature. These factors are less easy to define and individuals will have differing perceptions of what is intrusive and what is not. Subjective factors include whether the wind turbines are considered to be attractive, whether the rotation of the blades is considering disturbing, whether wind energy is perceived to be a good thing, or what 'value' is placed on the landscape.

Since it is not possible for subjective assessments to be made on behalf of an individual by a third party, it is essential that each and every individual concerned with a planning judgement should make their own assessment of the visual impact of the wind farm. For these judgements to be made fairly, it is necessary that the individual has an accurate knowledge and understanding of the modern wind turbine. In contrast, the objective assessment of visual impact can be provided by a third party since there is no personal judgement of impact involved in this type of assessment.

Thus our approach has been to provide objective assessments which can be used with an individual's own subjective assessments to derive some overall assessment of visual impact.

2.3 An objective approach to visual impact assessment

An objective approach to visual impact assessment has been used to create a record of all the landscape elements evident from a specific location (e.g. trees, hedgerows, footpaths, buildings, roads, pylons) and to provide a description of the landform and land cover of the wind farm site and the surrounding landscape. This approach seeks to ensure that the wind farm is considered a truly integrated part of the landscape when a visual impact judgement is being made.

This objective approach is based upon a method of landscape assessment suggested by the Countryside Commission (1) and which has been refined by Land Use Consultants (2). However, landscape assessment seeks to assign a 'value' to the landscape which necessitates objective and subjective assessments of the landscape. Subjective judgements of the stimulus provided by a landscape can only be carried out by a suitably qualified assessor, since landscape value is measured on a scale relative to other landscapes types. To assist this assessment, objective and subjective checklists are used to record the assessor's evaluation results. For visual impact assessment purposes, however, only the objective checklists of landscape characteristics have been used.

To support this approach, photomontage images are produced to illustrate the appearance of the wind farm from specific locations. Photomontages show the extent to which the wind turbines are visible,

their relative size in the landscape, their colour, and the organisation of the machines across the wind farm site. So that the photomontages portray the wind farm in the context of the whole landscape visible, panoramic scenes are created by joining together several photographs of the scene. Often panoramic views with up to 200 degrees field of view have been created to ensure that a record is made of the entire landscape visible from the assessment location. However, splitting the panorama in half provides two scenes with smaller fields of view that are more natural to the eye. These smaller vistas provide an accurate simulation or the appearance and scale of the wind farm in the landscape.

This approach to visual impact assessment is used to make impact assessment at each of the environmentally sensitive of public access locations identified during the search for the ZVI.

2.4 Presentation of the results of a visual impact assessment

The visual impact results are presented in a report supported by diagrams and photomontage images. The report includes:

(a) A description of the assessment techniques.
(b) A description of the wind farm site and the surrounding area.
(c) A description of the wind turbine model to be used.
(d) A description of the ZVI.
(e) A map showing the theoretical ZVI.
(f) Landform cross-section diagrams.
(g) A list of locations in the ZVI from which visual impact assessments are made.
(h) A description of the visual impact of the wind farm from each assessment location.
(i) Photomontages of key views.
(j) Conclusions.

The report has generally been included in the Environmental Impact Statement in its entirety.

3 OBSERVATIONS AND DISCUSSION

We have used the objective approach of visual impact assessment for six wind farm proposals and the assessment results have been submitted with the planning application of each wind farm project. There has been a mixed response to the visual impact assessment reports and it is useful to summarise our observations of their use in the planning process.

3.1 The Zone of Visual Influence

Reporting the results of the theoretical search for the ZVI provides a 'worst case' assessment of its extent. Often it conflicts with the description given of the ZVI because the theoretical method does not consider local obscuring features. In future, the theoretical approach will be used by RES Ltd as design tool to assist in locating the wind turbines in the least intrusive locations around the site.

The range of search should extend to a 10km radius around the site. Beyond this range, National Parks, Sites of Special Scientific Interest, Areas of Outstanding Natural Beauty, and Heritage footpaths should be identified and the likely visibility assessed.

3.2 Assessment locations

Specific locations within the ZVI should be identified from which visual impact assessments can be made. The list should consider environmentally sensitive locations and areas of public access. The list should be agreed after consultation with the local planning authority. This procedure will minimise the risk of locations of local significance being omitted from the assessment.

3.3 Landscape assessment

The use of an objective method of visual impact assessment based upon the methods used for landscape assessment have created some confusion. By using objective checklists for landform, land cover, and landscape features it was not our intention of assigning a 'value' to the landscape. It is our belief that if the planning authority requires an assessment of the landscape value of the wind farm site,

this must be carried out by independent agents of the authority and not by the developer. We consider that it is not appropriate for subjective assessments of the value of the wind farm site to be made by an 'interested party'. Certainly there would be little local sympathy for a wind farm proposal if emotive words such as bland or boring were used by the developer to describe the wind farm landscape.

Objective landscape assessment checklists were used to ensure that the landscape elements evident in the wind farm site and the surrounding were formally recorded. In this way, the wind farm becomes a additional element to that list. The key feature of this approach is that visual impact factors such as number of wind turbines seen, their arrangement in the landscape, the scale of the wind farm with respect to the landscape, etc., are evaluated. The results of this type of assessment would allow a judgement of whether the wind farm creates either 'a wind power landscape' or 'a landscape with wind power'.

3.4 Photomontages

Providing good quality photomontages for an acceptable cost to the developer is a critical issue. The photomontages are one of the most important aids for visual impact assessment and we perceive that most visual impact judgements are based upon the inspection of these simulated views of the wind farm. It is essential that a range of viewing experiences are portrayed by the photomontages and should include some middle distance viewpoints (i.e. up to 3km from the site).

3.5 Visual impact assessment

Our experience shows that there is still confusion between visibility and visual impact. And while the objective approach to visual impact assessment provides useful information for the planning professionals (e.g. local planning officers, Countryside Commission), we perceive that little use has been made of this information when others (e.g. members of the planning committee, the public) have made their visual impact assessments. The photomontages illustrate much of the objective information contained the report, however, unless the report is read, most of this information may be ignored when making a visual impact judgement.

Similarly, to make a fair and honest judgement about the likely visual impact of a wind farm, an accurate knowledge or perception of wind turbine characteristics is required. This cannot be gained from inspection of the photomontages, but rather from visiting a modern wind farm or wind turbine. However, in 1991, when most planning applications for wind farms were submitted to local planning authorities, there was only a small number of stand-alone machines erected in the U.K. Now, with the erection of the wind farm at Delabole, Cornwall, planning officers, planning committee members, and members of the public can experience first hand a wind farm in the U.K. This wind farm, and those that follow, will enable people to check for themselves whether the myths and mis-conceptions about wind turbines that are often raised in objection to wind farm projects are valid. Clearly, as planning authorities become more experienced with dealing with applications for wind farms, so their ability to make subjective judgements about the visual impact of a wind farm will be enhanced.

Finally, the visual impact assessment prepared by the developer only considers one specific site. The culmulative effect of more than one wind farm in the same region need not be addressed by the developer; this task must be undertaken by the local planning authority will have to assess the cumulative impact of nearby wind farms.

3.6 The way forward

The following are recent occurences that may influence the way visual impact assessment is carried out in the future.

(a) The Department of Environment issued a draft copy of its Planning Policy Guidance (PPG) for renewable energy. The document is aimed at planning officers and part considers the issue of visual impact assessment. Amongst its many guidelines, it is noted that an objective approach to assessment is recommended, based along the same Countryside Commission Document considered here.

(b) The Inspector's report on the public enquiry for the Cemmais wind farm contains several references to visual impact issues. This report should usefully serve planning officers by providing guidance on many of the subjective issues of visual impact. The report differentiates between the issues of visibility and visual impact.

(c) Chris Blandford Associates published a landscape impact assessment for Dyfed which identifies areas they consider suitable for wind energy exploitation. The countywide assessment of the technical feasibility of wind energy exploitation combined with an evaluation of the landscape value, provides Dyfed planning officers with a means of assessing the suitability of future wind farm projects in their region.

(d) Delabole wind farm provides an excellent means by which planning authorities and members of the public can gain real experience of a large cluster of wind turbines operating in a U.K. landscape. This exposure to a wind farm should serve to reduce the influence of the subjective issues of visual impact assessment as the doubts of the unknown become displaced by concrete experiences.

4 CONCLUSIONS

Visual impact assessment of wind farms demands the consideration of many issues, some of which are highly subjective. The approach described in this paper considers the objective issues of visibility and visual impact. The final assessment of visual impact relies upon the individual making subjective judgements based upon the information provided. This objective approach has proved to be of use to planning professionals, but it is perceived that this type of information has not been fully utilised by others when formulating their own conclusions about the visual impact of a proposed wind farm.

Several recent events may assist in determining a common approach to visual impact assessment, but in the mean time, a wind farm developer needs to approach the issue of visual impact assessment in a logical and ordered manner, working with the full co-operation of the local planning authority.

REFERENCES

(1) Landscape Assessment: a Countryside Commision approach. CCD 18, 1987.
(2) Environmental aspects of wind farms: a report for the Countryside Commision. Land Use Consultants, London, 1990.